

papers in the journals and books of professional organizations, technological associations, and commercial publications. The calibration services, standard reference materials and related measurement services along with changes and fees are published in two Special Publications (SP's) and their supplements. These are SP 250 "Calibration and Related Measurement Services of the National Institute of Standards & Technology"¹ and SP 260 "NIST Standard Reference Materials Catalog."¹ A complete catalog of all publications by NIST authors is issued annually as a supplement to SP 305 "Publications of the National Institute of Standards & Technology." Announcements and listings of recent NIST publications and services are published in each issue of the bimonthly "NIST Journal of Research"² and the NIST monthly magazine, "Dimensions/NIST"². Complete citations to NIST publications, along with information on availability are published bimonthly in the "NIST Publications Newsletter", available free from the Technical Information and Publications Division, National Institute of Standards & Technology, Washington, DC 20234. NIST publications are also announced (with abstracts) in "Government Reports Announcements and Index" published every two weeks by the National Technical Information Service (NTIS), Springfield, Virginia 22161³. NTIS also sells microfiche copies of all NIST GPO-published documents, as well as paper copy and microfiche versions of NIST Interagency Reports.

¹Single copies available free from the National Institute of Standards & Technology, Washington, DC 20234.

²For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, for a subscription price. The annual subscription price for the NIST Journal of Research on the date of the publication of these regulations is \$13.00 and for Dimensions/NIST it is \$11.00. Prices, however, for these publications are subject to change without notice.

³The annual subscription rate at the date of the publication of these regulations for this service is \$275.00, North American Continent, \$375.00 all others.

§ 200.107 WWV-WWVH-WWVB broadcasts.

(a) *Technical services.* The NIST radio stations WWV at Fort Collins, Colorado, and WWVH on the island of Kauai, Hawaii, broadcast a number of technical services continuously night and day. These services are:

(1) Standard radio frequencies, 2.5, 5, 10, 15, and 20, MHz (WWV) and 2.5, 5, 10, and 15 MHz (WWVH); (2) standard time signals; (3) time intervals; (4) UTI corrections; (5) standard audio frequencies; (6) standard musical pitch; (7) a slow time code; (8) Omega Navigation System status reports; (9) geophysical alerts; and (10) marine storm warnings. NIST also broadcasts time and frequency signals from its low frequency station, WWVB, also located at Fort Collins, Colorado.

(2) [Reserved]

(b) *Time announcements.* Once per minute voice announcements are made from WWV and WWVH. The two stations are distinguished by a female voice from WWVH and a male voice from WWV. The WWVH announcement occurs first, at 15 seconds before the minute, while the WWV announcement occurs at 7½ seconds before the minute. Coordinated Universal Time (UTC) is used in these announcements.

(c) *Time corrections.* The UTC time scale operates on atomic frequency, but by means of step adjustments is made to approximate the astronomical UTI scale. It may disagree from UTI by as much as 0.9 second before step adjustments of exactly 1 second are made. These adjustments, or leap seconds are required about once per year and will usually be made on December 31 or June 30. For those who need astronomical time more accurately than 0.9 second, a correction to UTC is encoded by the use of double ticks after the start of each minute. The first through the eighth seconds ticks will indicate a "plus" correction, and from the ninth through the 16th a "minus" correction. The correction is determined by counting the number of double ticks. For example, if the first, second, and third ticks are doubled, the correction is "plus" 0.3 second. If the ninth, 10th, 11th, and 12th ticks are doubled, the correction is "minus" 0.4 second.

(d) *Standard time intervals.* An audio pulse (5 cycles of 1000 Hz on WWV and 6 cycles of 1200 Hz on WWVH), resembling the ticking of a clock, occurs each second of the minute except on the 29th and 59th seconds. Each of these 5-millisecond second pulses occur within a 40-millisecond period, wherein all other modulation (voice or tone) is removed from the carrier. These pulses begin 10 milliseconds after the modulation interruption. A long pulse (0.8 second) marks the beginning of each minute.

(e) *Standard frequencies.* All carrier and audio frequencies occur at their nominal values according to the International System of Units (SI). For periods of 45-second duration, either 500-Hz or 600-Hz audio tones are broadcast in alternate minutes during most of each hour. A 440-Hz tone, the musical pitch A above middle C, is broadcast once per hour near the beginning of the hour.

(f) *Accuracy and stability.* The time and frequency broadcasts are controlled by the NIST atomic frequency standards, which realize the internationally defined cesium resonance frequency with an accuracy of 1 part in 10^{13} . The frequencies transmitted by WWV and WWVH are held stable to better than ± 2 parts in 10^{11} at all times. Deviations at WWV are normally less than 1 part in 10^{12} from day to day. Incremental frequency adjustments not exceeding 1 part in 10^{12} are made at WWV and WWVH as necessary. Changes in the propagation medium (causing Doppler effect, diurnal shifts, etc.) result in fluctuations in the carrier frequencies as received which may be very much greater than the uncertainties described above.

(g) *Slow time code.* A modified IRIG H time code occurs continuously on a 100-Hz subcarrier. The format is 1 pulse per second with a 1-minute time frame. It gives day of the year, hours, and minutes in binary coded decimal form.

(h) *Omega announcements.* Omega Navigation System status reports are broadcast in voice from WWV at 16 minutes after the hour and from WWVH at 47 minutes after the hour. The international Omega Navigation System is a very low frequency (VLF) radio navigation aid operating in the 10 to 14 kHz frequency band. Eight sta-

tions are in operation around the world. Omega, like other radio navigation systems, is subject to signal degradation caused by ionospheric disturbances at high latitudes. The Omega announcements on WWV and WWVH are given to provide users with immediate notification of such events and other information on the status of the Omega system.

(i) *Geophysical alerts.* These occur in voice at the 18th minute of each hour from WWV. They point out outstanding events which are in process, followed by a summary of selected solar and geophysical events in the past 24 hours and a forecast for the next 24 hours. They are provided by the Space Environment Laboratory, National Oceanic and Atmospheric Administration, Boulder, CO 80303.

(j) *Marine storm information.* Weather information about major storms in the Atlantic and eastern North Pacific are broadcast in voice from WWV at 8, 9, and 10 minutes after each hour. Similar storm warnings covering the eastern and central North Pacific are given from WWVH at 48, 49, and 50 minutes after each hour. An additional segment (at 11 minutes after the hour on WWV and at 51 minutes on WWVH) may be used when there are unusually widespread storm conditions. The brief messages are designed to tell mariners of storm threats in their areas. If there are no warnings in the designated areas, the broadcasts will so indicate. The ocean areas involved are those for which the U.S. has warning responsibility under international agreement. The regular times of issue by the National Weather Service are 0500, 1100, 1700, and 2300 UTC for WWV and 0000, 0600, 1200, and 1800 UTC for WWVH. These broadcasts are updated effective with the next scheduled announcement following the time of issue.

(k) *"Silent" periods.* These are periods with no tone modulation during which the carrier, seconds ticks, minute time announcements, and 100 Hz modified IRIG H time code continue. They occur during the 16th through the 20th minute on WWVH and the 46th through the 51st minute on WWV.

(l) *WWVB.* This station (antenna coordinates 40°40'28.3" N., 105°02'39.5" W.; radiated power 12 kw.) broadcasts on 60

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kHz. Its time scale is the same as for WWV and WWVH, and its frequency accuracy and stability are the same. Its entire format consists of a 1 pulse per second special binary time code giving minutes, hours, days, and the correction between its UTC time scale and UTI astronomical time. Identification of WWVB is made by its unique time code and a 45° carrier phase shift which occurs for the period between 10 minutes and 15 minutes after each hour. The useful coverage area of WWVB is within the continental United States. Propagation fluctuations are much less with WWVB than with high-frequency reception, permitting frequency comparisons to be made to a few parts in 10¹¹ per day.

(m) *Special Publication 432*. This publication describes in detail the standard frequency and time service of NIST. Single copies may be obtained at no charge upon request from the National Institute of Standards & Technology, Time & Frequency Services Group, 524.06, Boulder, CO 80303. Quantities may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, at a nominal charge per copy.

§ 200.108 Request procedure.

(a) A formal purchase order for the calibration or test should be sent before or at the time the instrument or standard is shipped. The purchase order should provide clear identification of the apparatus being submitted, and give separate instructions for return shipment, mailing of report, and billing. If a customer wishes to minimize the time during which the equipment is out of service, the customer can usually arrange to be notified of the scheduled test date to allow timely shipment. (See §200.110.) Requests from Federal agencies, or from State agencies, for calibrations or tests on material to be used on private or Federal contract work should be accompanied either by purchase order or by letter or document authorizing the cost of the work to be billed to the agency.

(b) The submission of a purchase order for measurement services under this subchapter shall be understood as constituting an agreement on the part of the customer to be bound by the re-

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strictions on the use of results as set forth in §200.113 of this part. Acceptance of purchase orders does not imply acceptance of any provisions set forth in the order contrary to the policy, practice, or regulations of NIST or the U.S. Government. (A statement to the effect that NIST is an agency of the U.S. Government should satisfy other Government agencies with regard to compliance with Government regulations and Executive orders.)

(c) A test number will be assigned by NIST to each instrument or group of similar instruments or standards when the order is accepted. This test number should be referred to in all subsequent communications. Also, each instrument in a group must be uniquely identified, usually by the manufacturer's name and instrument serial number. When the serial number is lacking, an alternative identifying mark should be provided. If none is found, NIST will mark the piece with an NIST identification number. If the apparatus submitted has been previously calibrated by NIST, the serial number or identifying mark should be given on the new order, so that a continuing record of stability history can be established.

(d) Inquiries for measurement services should be directed to the NIST address listed in the various sections of the Appendix to SP 250.

§ 200.109 Shipping, insurance, and risk of loss.

(a) Shipment of apparatus to NIST for calibration or other test should be made only after the customer has accepted the estimate of cost and the tentative scheduling. Repairs and adjustments on apparatus submitted should be attended to by the owner, since NIST will not undertake them except by special arrangement. Apparatus not in good condition will not be calibrated. If defects are found after calibration has begun, the effort may be terminated, a report issued summarizing such information as has been found, and a fee charged in accordance with the amount of work done.

(b) The customer should pack apparatus sent to NIST so as to minimize the likelihood of damage in shipment and handling. Suggestions on packing and shipping are made in some sections